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(71)Applicant : NISSAN MOTOR CO LTD

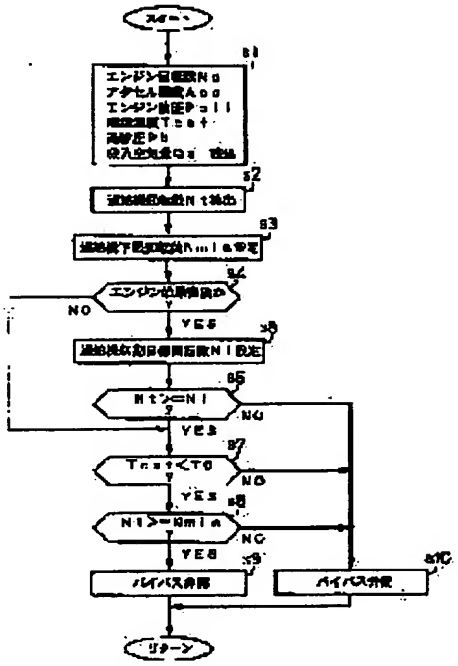
(72)Inventor : KAWAMOTO KEIJI

(54) INTERNAL COMBUSTION ENGINE WITH TURBOCHARGER

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent any oil leakage from a center housing by maintaining the number of rotation of a turbocharger in a predetermined range when activating a catalyst by bypassing a turbine of a turbocharger.

SOLUTION: When the catalyst temperature Tcat is lower than the predetermined temperature T0, and the catalyst must be heated (S7), the exhaust emission is allowed to flow via a bypass passage to bypass the turbine of the turbocharger, and the exhaust emission of large calorie is fed to the catalyst. When the number of rotation Nt of the turbocharger is smaller than the predetermined lower limit number of rotation Nmin (S8), the bypassing is prohibited (S10), and the quantity of exhaust emission flowing into the turbine is increased to maintain the rotation of the turbocharger.



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CLAIMS

[Claim(s)]
[Claim 1] He is an internal combustion engine with a supercharger having the exhaust emission control device installed in the flueway on the lower stream of a river of the turbine of a supercharger, and this turbine. The bypass path which opens the upstream for free passage rather than said exhaust emission control device among the upstream of said turbine, and the lower stream of a river of said turbine, It has the bypass valve installed in this bypass path, and the bypass valve control unit which controls the by-pass rate which is a flow rate of the exhaust air which controls this bypass valve and flows said bypass path. The supercharge mode made to supercharge by said bypass valve control device making said by-pass rate min, The catalyst temperature up mode in which the temperature up of the exhaust air purification catalyst with which enlarges said by-pass rate and said exhaust emission control device is equipped is made to perform, It is constituted including the mode means for switching which switches alternatively the rotation maintenance mode in which make said by-pass rate smaller than the thing in said catalyst temperature up mode, and a supercharger rotational frequency is raised more than a predetermined rotational frequency. Said mode means for switching chooses supercharge mode, when the temperature of said exhaust air purification catalyst is beyond predetermined temperature. The internal combustion engine with a supercharger characterized by choosing catalyst temperature up mode when this temperature is lower than said predetermined temperature and a supercharger rotational frequency is more than a predetermined rotational frequency, and choosing rotation maintenance mode when [when this temperature is lower than said predetermined temperature] a supercharger rotational frequency is lower than said predetermined rotational frequency.
[Claim 2] He is an internal combustion engine with a supercharger having the exhaust emission control device installed in the flueway on the lower stream of a river of the turbine of a supercharger, and this turbine. The bypass path which opens the upstream for free passage rather than said exhaust emission control device among the upstream of said turbine, and the lower stream of a river of said turbine, It has the bypass valve installed in this bypass path, and the bypass valve control unit which controls the by-pass rate which is a flow rate of the exhaust air which controls this bypass valve and flows said bypass path. The supercharge mode made to supercharge by said bypass valve control device making said by-pass rate min, The mode means for switching which switches alternatively the catalyst temperature up mode in which the temperature up of the exhaust air purification catalyst with which is made to increase said by-pass rate and said exhaust emission control device is equipped is made to perform, It is constituted including a setting means whenever [valve-opening / which sets up the opening of said bypass valve according to the selected mode]. Said mode means for switching When the temperature of said exhaust air purification catalyst is beyond predetermined temperature, while choosing supercharge mode, when this temperature is lower than said predetermined temperature, catalyst temperature up mode is chosen. Whenever [said valve-opening] a setting means He is the internal combustion engine with a supercharger characterized by setting up the opening of said bypass valve based on a supercharger rotational frequency, and making this opening small as compared with the time beyond it when this rotational frequency is lower than a predetermined rotational frequency when it is in catalyst temperature up mode.
[Claim 3] A setting means is an internal combustion engine with a supercharger according to claim 2 with which the time when a supercharger rotational frequency is lower decreases this opening in case the opening of said bypass valve is set up in catalyst temperature up mode whenever [said valve-opening].
[Claim 4] He is the internal combustion engine with a supercharger according to claim 2 which makes this opening min whenever [said valve-opening] when a supercharger rotational frequency is lower than said predetermined rotational frequency in case a setting means sets up the opening of said bypass valve in catalyst temperature up mode.
[Claim 5] The internal combustion engine with a supercharger of any one publication of claim 1-4 which sets immediately after engine starting and is switched to the 2nd value with said predetermined rotational frequency usually higher than the 1st value at the time.
[Claim 6] The internal combustion engine with a supercharger of any one publication of claim 1-5 by which the time when said predetermined rotational frequency of lubrication oil pressure is higher is set as a high value.
[Claim 7] Said bypass valve control unit is an internal combustion engine with a supercharger of any one publication of claim 1-6 by which a supercharger rotational frequency is detected based on the intake pressure which has a means to detect the intake pressure in the lower stream of a river of the compressor of said supercharger, and was detected by this means.
[Claim 8] Said bypass valve control unit is an internal combustion engine with a supercharger of any one publication of claim 1-7 by which a supercharger rotational frequency is detected based on the inhalation air content which has a means to detect an inhalation air content and was detected by this means.
[Claim 9] Said bypass valve control unit is an internal combustion engine with a supercharger of any one publication of claim 1-8 which has a means to presume or detect the temperature of the support of said exhaust air purification catalyst.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About an internal combustion engine with a supercharger, this invention relates to amelioration of the technique of activating the exhaust air purification catalyst with which an exhaust emission control device is equipped, by making this turbine bypass and passing exhaust air in the internal combustion engine which equips the lower stream of a river of that turbine with an exhaust emission control device, while equipping a detail with a turbosupercharger.
[0002]
[Description of the Prior Art] In order to purify the exhaust air from a diesel power plant in recent years, reducing HC (hydrocarbon), CO (carbon monoxide), and NOx (nitrogen oxides) under exhaust air using a catalyst is beginning to be used. Here, although a turbosupercharger is generally prepared and improvement in an output is achieved by the diesel power plant, since an exhaust-gas temperature essentially becomes low, the service condition which reaches the temperature from which a catalyst will be in an active state will be restricted, and there is a problem that the exhaust air purification effectiveness by the catalyst is low.
[0003] While the path which bypasses the turbine of a supercharger is prepared to this problem and the catalyst is not being activated, supplying the exhaust air with which the turbine was bypassed and the heating value was held to a catalyst is known by passing exhaust air through this path (refer to JP,05-044448,A).
[0004]
[Problem(s) to be Solved by the Invention] However, a lubricating oil may begin to leak to a turbine side only by carrying out to making exhaust air only bypass at the time of catalyst inactive, without the oil seal from pin center,large housing of a turbosupercharger fully functioning. That is, it is because the lubricating oil to which the force in which fell too much and the seal member of a turbine shaft was forced on pin center,large housing became weaker, and the engine speed was supplied to the bearing will begin to leak to a turbine side if it is make it bypass only with a catalyst be in a low-temperature condition here, although a supercharger engine speed will fall in order that the force of make it circle in a turbine may decline between bypasses. Since leakage of such a lubricating oil makes HC under exhaust air increase, it not only making lubricating oil consumption only increase but has a bad influence on an exhaust air property.
[0005] Then, this invention is faced making a turbine bypass and attaining activation of a catalyst, and aims at solving the conventional problem of leakage of a lubricating oil by maintaining a supercharger rotational frequency in the predetermined range.
[0006]
[Means for Solving the Problem] For this reason, in the internal combustion engine with a supercharger having the exhaust emission control device installed in the flueway on the lower stream of a river of the turbine of a supercharger, and this turbine, among the upstream and the lower streams of rivers of the above-mentioned turbine, the upstream was opened for free passage at the bypass path and the bypass valve was installed in this bypass path rather than the exhaust emission control device in invention according to claim 1. And form the bypass valve control unit which controls the by-pass rate which is a flow rate of the exhaust air which controls this bypass valve and flows a bypass path, and it sets to this equipment. The supercharge mode which a by-pass rate is made to supercharge by considering as min, and the catalyst temperature up mode in which the temperature up of the exhaust air purification catalyst with which enlarges a by-pass rate and an exhaust emission control device is equipped is made to perform, It had the mode means for switching which switches alternatively the rotation maintenance mode in which make a by-pass rate smaller than the thing in catalyst temperature up mode, and a supercharger rotational frequency is raised more than a predetermined rotational frequency. Furthermore, the mode means for switching chose supercharge mode, when the temperature of an exhaust air purification catalyst was beyond predetermined temperature, when this temperature was lower than said predetermined temperature and a supercharger rotational frequency was more than a predetermined rotational frequency, it chose catalyst temperature up mode, and when [when this temperature is lower than said predetermined temperature] a supercharger rotational frequency was lower than said predetermined rotational frequency, it constituted it so that rotation maintenance mode might be chosen.
[0007] the time of according to such a configuration, supercharge being performed, a by-pass rate being used as min by supercharge mode, when an exhaust air purification catalyst is an elevated temperature, but this being low temperature and needing compulsory heating -- catalyst temperature up mode -- or rotation maintenance mode is chosen. Here, it is a heating demand that catalyst temperature up mode is chosen, and it is at the time when a supercharger rotational frequency is to some extent high. As for the engine speed as this threshold, it is desirable to be set up in connection with the oil seal prepared in a turbine shaft, and if it fluctuates according to lubrication oil pressure so that it may mention later, it is more suitable. Although emphasis will be put on the temperature up of an exhaust air purification catalyst in catalyst temperature up mode, since the supercharger is rotating at high speed, it is possible to operate oil seal proper.
[0008] It is a time of the supercharger rotational frequency being low (or a predetermined rotation region not being once arrived at from engine starting) that rotation maintenance mode is chosen on the other hand, although it is a heating demand. When a by-pass rate is made [many] too much at this time, a supercharger rotational frequency is insufficient and there is a possibility that it may become impossible to operate oil seal proper. Therefore, in rotation maintenance mode, although it is desirable to make a bypass perform the temperature up of an exhaust air purification catalyst, suppose that it takes into consideration also to rotation maintenance of a supercharger. Early activation of an exhaust air purification catalyst can be attained making this temperature up by this perform in the limit where oil seal can be operated proper, and preventing the oil spillage by the side of a turbine.
[0009] Especially in invention according to claim 2, the setting means was established in the above-mentioned bypass valve control device whenever [mode means-for-switching / which switches alternatively the supercharge mode which the (A) by-pass rate is made to supercharge by considering as min and the catalyst temperature up mode in which make a by-pass rate increase and the temperature

up of an exhaust air purification catalyst is made to perform /, and valve-opening / which sets up the opening of a bypass valve according to the mode by which (B) selection was made]. And when the temperature of an exhaust air purification catalyst is beyond predetermined temperature, while choosing supercharge mode in a mode means for switching It is supposed that catalyst temperature up mode is chosen when this temperature is lower than said predetermined temperature. Whenever [valve-opening] with a setting means When it was in catalyst temperature up mode, the opening of a bypass valve was set up based on the supercharger rotational frequency, and when this rotational frequency was lower than a predetermined rotational frequency, we decided to make this opening small as compared with the time beyond it.

[0010] Unlike a thing according to claim 1, the mode is divided into the supercharge mode chosen when it divides roughly and there is no heating demand, and the catalyst temperature up mode chosen as a heating demand with such a configuration. However, in catalyst temperature up mode, since the opening of a bypass valve is set up based on a supercharger engine speed, and a by-pass rate is lessened when this engine speed is lower than a predetermined engine speed, it is possible to acquire the same effectiveness as claim 1.

[0011] When a setting means set up the opening of a bypass valve in catalyst temperature up mode whenever [above-mentioned valve-opening], it was made for the time when a supercharger rotational frequency is lower to decrease this opening in invention according to claim 3. In invention according to claim 4, when a setting means set up the opening of a bypass valve in catalyst temperature up mode whenever [valve-opening], and a supercharger rotational frequency was lower than the above-mentioned predetermined rotational frequency, we decided to make this opening into min.

[0012] According to invention according to claim 5, we decided to set immediately after engine starting and to switch the above-mentioned predetermined rotational frequency to the 2nd value usually higher than the 1st value at the time. According to such a configuration, at the time of engine starting, when an exhaust air purification catalyst is low temperature, rotation maintenance mode (claim 1) or catalyst temperature up mode (claim 2) is first chosen by the temperature and the supercharger rotational frequency of an exhaust air purification catalyst after starting. It is desirable that a prompt rotation rise is achieved here, a by-pass rate being used as min. Then, before an exhaust air purification catalyst is activated, the same mode will continue being chosen until a supercharger rotational frequency reaches the above-mentioned predetermined rotational frequency. Here, since a predetermined rotational frequency is made into the 2nd comparatively high value immediately after engine starting, a supercharger rotational frequency will be first raised even to this 2nd value compulsorily. Therefore, since the number of supercharger rotations is not immediately less than the number of rotations of the 1st value even if a rotation rise of a supercharger is acquired and a by-pass rate is increased, a condition with many by-pass rates can be made to continue for a long time.

[0013] In invention concerning claim 6, the time when lubrication oil pressure is higher presupposed that the above-mentioned predetermined rotational frequency is set as a high value. That is, since a lubricating oil will leak to a turbine side and it will so become easy to take it out if lubrication oil pressure is high even if a supercharger engine speed is the same, it is for maintaining a supercharger engine speed highly according to the rise of lubrication oil pressure. Here, although they may be a thing immediately after engine starting (the 1st value), and any of the thing at the time usually (the 2nd value), the predetermined rotational frequency is suitable if these both are set up based on lubrication oil pressure.

[0014] In invention according to claim 7, a means to detect the intake pressure in the lower stream of a river of the compressor of a supercharger to a bypass valve control unit is established, and the supercharger rotational frequency was detected based on the intake pressure detected by this means. In invention according to claim 8, a means to detect an inhalation air content to a bypass valve control unit is established, and the supercharger rotational frequency was detected based on the inhalation air content detected by this means.

[0015] In invention according to claim 9, a means to presume or detect the temperature of the support of an exhaust air purification catalyst to a bypass valve control unit was established.

[0016]

[Effect of the Invention] Since a supercharger engine speed can be maintained proper in case according to invention concerning claim 1 a turbine is made to bypass and the temperature up of an exhaust air purification catalyst is made to perform, the force in which the seal member of a turbine shaft is forced on pin center,large housing is secured, and discharge of HC by the oil spillage by the side of a turbine can be prevented.

[0017] According to invention concerning claim 2, the effectiveness of claim 1 and the same effectiveness can be acquired. Since the temperature up of an exhaust air purification catalyst can be made to perform in the limit where this is maintainable proper according to invention concerning claim 3 even if it is at the time when a supercharger rotational frequency is low, the activity time amount of a catalyst can be shortened.

[0018] According to invention concerning claim 4, too much fall of a supercharger engine speed can be certainly prevented by making opening of a bypass valve into min, when a supercharger engine speed is lower than a predetermined engine speed. According to invention concerning claim 5, after engine starting, a condition with many by-pass rates can be made to be able to continue after that for a long time, and an exhaust air purification catalyst can be promptly activated by pulling up a supercharger even in a predetermined high rotation region first.

[0019] According to invention concerning claim 6, an oil spillage can be certainly prevented by maintaining a supercharger rotational frequency highly, without being based on operational status, so that lubrication oil pressure is high. According to invention concerning claims 7 and 8, simple control logic and effectiveness [more than / a comparatively cheap sensor] can be acquired by detecting a supercharger engine speed based on the down-stream intake pressure or down-stream inhalation air content (or these both) of a compressor of a supercharger.

[0020] According to invention concerning claim 9, the temperature of an exhaust air purification catalyst is correctly detectable with the temperature of support.

[0021]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is the block diagram of the internal combustion engine (henceforth an "engine") 1 concerning 1 operation gestalt of this invention. The air filter (not shown) is attached in the inhalation-of-air path 3 connected to the engine 2 at induction, and the dust which floats in inhalation air is removed here. And the detecting signal corresponding to an inhalation air content is outputted from the air flow meter 31 of an air filter installed immediately down-stream, and it is inputted into an electronic control unit (it abbreviates to "ECU" below.) 41.

[0022] Compressor 4a of a turbosupercharger 4 is infixed in the inhalation-of-air path 3, and the inhalation air through an air flow meter 31 is compressed by compressor section 4a, and is sent out. The inhalation air fed by compressor section 4a is distributed to each gas column in the manifold section. An engine 2 is made to face in the center of up abbreviation of the combustion chamber of each gas column, and the electronics control type fuel injection valve (henceforth a "injector") 5 is installed. The fuel compressed into the predetermined pressure by the fuel pump is introduced into a common rail 6 through a fuel charging line, and is supplied to each

injector 5 from there. An injector 5 operates according to the fuel-injection control signal from ECU41, carries out an open drive at predetermined fuel injection timing, and injects the fuel of the specified quantity directly into a cylinder.
[0023] Turbine 4b of a turbosupercharger 4 is installed in the flueway 7. It cannot be overemphasized that it is combined by the shaft in ** and a compressor wheel rotates because the exhaust air which flowed into turbine 4b rotates a turbine wheel, and the charging efficiency of the compressor wheel [the turbine wheel of turbine 4b and] of compressor 4a improves.
[0024] Moreover, in the flueway 7, the upstream is opened for free passage by the bypass path 9 rather than the exhaust emission control device 8 later mentioned among the downstream and the lower stream of a river of turbine 4b rather than the juncture of the manifold section among the upstream of turbine 4b of a turbosupercharger 4. The bypass valve (here butterfly valve) 10 for adjusting this opening area is installed in the bypass path 9. To the bypass valve 10, the actuators 11, such as a stepping motor which controls the opening, are connected. Here, if an actuator 11 opens a bypass valve 10 according to the bypass valve control signal from ECU41, the exhaust air control of flow is carried out [exhaust air] by the opening area at that time bypasses turbine 4b, and joins the flueway of the lower stream of a river of turbine 4b. The exhaust air through turbine 4b and the exhaust air which bypassed turbine 4b through the bypass path 9 are emitted into atmospheric air, after purification processing is carried out in both the exhaust emission control devices 8.
[0025] The exhaust air purification catalyst for purifying exhaust air of a diesel power plant is supported by the exhaust emission control device 8. As this catalyst, an oxidation catalyst and an NOx trap catalyst are suitable. What has the function which says what has the function in which an oxidation catalyst oxidizes unburnt fuel components, such as CO and HC, here, emits NOx which is carrying out the trap if an air-fuel ratio becomes rich while carrying out the trap of NOx while exhausting an NOx trap catalyst here, when an air-fuel ratio is Lean, and is returned is said.
[0026] As other exhaust emission control devices 8, what built in DPF (diesel particulate filter) is mentioned. Here, DPF means the porous body which becomes extent which can carry out filtration uptake of the particulate matter discharged from a diesel power plant from a fine ceramic etc. In addition, the catalyst bed which uses an oxidation catalyst etc. as a catalyst component is formed in this DPF.
[0027] As a sensor formed in an engine 1 Besides an air flow meter 31 The crank angle sensor 32 which detects the unit crank angle or criteria crank angle used in case an engine speed Ne is computed, the accelerator sensor 33 which detects the accelerator opening Acc equivalent to an operator's accelerator control input, the pressure of engine lubricant (it is called "engine oil pressure" below.) The oil pressure sensor 34 which detects Poil, and the charge pressure sensor 35 which detects the pressure in the collector 12 of the inhalation-of-air path 3 as charge pressure Pb are formed. Moreover, the sensor 36 is attached in the exhaust emission control device 8 whenever [for detecting the temperature (henceforth "whenever / catalyst temperature /") Tcat of the exhaust air purification catalyst currently supported / catalyst temperature]. Whenever [catalyst temperature], the sensor 36 is constituted so that the temperature of the support of a catalyst may be detected. Each detecting signal of these sensors 31-36 is inputted into ECU41.
[0028] Next, opening control of a bypass valve 10 is explained among the control performed by ECU41 with reference to the flow chart shown in drawing 2 . Here, ECU41 transmits a bypass valve control signal so that it may state below to an actuator 11 for this control. At step (it abbreviates to "S" below.) 1, Tcat, charge pressure Pb, and the inhalation air content Qa are read based on the input signal from each sensors 31-36 whenever [engine-speed Ne, accelerator opening Acc, engine oil pressure Poil, and catalyst temperature].
[0029] In S2, the supercharger rotational frequency Nt of a supercharger 4 is detected based on the inhalation air content Qa and charge pressure Pb. This detection is constructively performed with reference to the map which imitated the actuation characteristic ray Fig. of compressor 4a shown in drawing 3 . Here, the supercharger rotational frequency Nt is detected as such a low value that charge pressure Pb is so low that there are few inhalation air contents Qa. In S3, based on the engine oil pressure Poil, as shown in drawing 4 , the supercharger minimum rotational frequency Nmin is set up.
[0030] Here, the minimum engine speed Nmin is set up as a limitation that a proper oil seal function (a turbine shaft is generally equipped with the piston ring as a seal member.) is obtained in pin center,large housing of a supercharger 4. That is, if the supercharger engine speed Nt falls too much, since the force in which a seal member is forced on pin center,large housing will become weaker and lack of an oil seal function will be caused, the forcing force of a seal member makes the minimum engine speed Nmin the minimum engine speed within the limits obtained by predetermined. However, if the basis of the same supercharger engine speed Nt also compares the case where the engine oil pressure Poil is high with the case of being low, since the force in which former one extrudes a lubricating oil outside will become strong, it is easy to cause the oil spillage into turbine housing. Therefore, as for the minimum engine speed Nmin, it is desirable to be suitably changed according to the engine oil pressure Poil, and the time when Poil is higher is set as a high value. In addition, Nmin is equivalent to the "1st value" of the predetermined rotational frequency concerning a supercharger rotational frequency.
[0031] In S4, it judges whether it is immediately after current and engine starting. As this judgment approach, the elapsed time from engine starting is computed by inputting the off signal of a start switch, for example, and it judges with it being immediately after engine starting with this elapsed time being less than predetermined time. Or it is good also considering until it exceeds first the initial target engine speed nickel which the supercharger engine speed Nt mentions later from engine starting as immediately after engine starting.
[0032] Below, the control flow restricted to the time zone immediately after engine starting is explained first. When it judges with it being immediately after current and engine starting, it progresses to S5 from S4, and based on the engine oil pressure Poil, the initial target rotational frequency nickel of a supercharger is set up so that it may be shown drawing 5 .
[0033] here -- the initial target engine speed nickel -- the supercharger engine speed Nt -- the same -- a value with the higher time when the engine oil pressure Poil is higher -- and it is set as a value higher than the minimum engine speed Nmin as the 1st value to fixed Poil. In addition, nickel is equivalent to the "2nd value" of the predetermined rotational frequency concerning a supercharger rotational frequency. In S6, it judges whether the supercharger rotational frequency Nt is more than the initial target rotational frequency nickel. While the engine starting back Nt is lower than nickel, it progresses to S10 and the close by-pass bulb completely of the bypass valve 10 is carried out. By this actuation, the great portion of exhaust air will be passed by turbine 4a in the meantime. And it is continued until the supercharger (not based on Tcat whenever [catalyst temperature]) rotational frequency Nt reaches the initial target rotational frequency nickel, and the condition of having done in this way and having closed the bypass valve 10 can pull up a supercharger 4 from engine starting promptly even in a predetermined high rotation region.
[0034] When the supercharger 4 is rotating in S6 above the initial target rotational frequency nickel, processing after S7 mentioned later is performed. Next, it explains from S4 that the point flows as control after carrying out predetermined time progress from engine starting. When it judges with it not being immediately after engine starting in S4, it progresses to S7 and judges whether Tcat is [whenever / catalyst temperature] lower than the predetermined temperature T0. Here, T0 is set as the activity minimum temperature (for example, 200 degrees C) of the exhaust air purification catalyst with which an exhaust emission control device 8 is equipped.

When it judges with Tcat being lower than T0, it is S8 HE ****.
[0035] In S8, it judges whether the supercharger rotational frequency Nt is more than the minimum rotational frequency Nmin. Here, only when it judges with Nt being more than Nmin, it progresses to S9, and suppose that a bypass valve 10 is opened. On the other hand, when it judges with Nt being lower than Nmin, even if it is a time of there being an exhaust air purification catalyst and changing a temperature up into an inactive condition, it progresses to S10, and the close by-pass bulb completely of the bypass valve 10 is carried out. According to this actuation, there will be some delay in activation of an exhaust air purification catalyst. However, since the supercharger rotational frequency Nt rises, the fall of an oil seal function is prevented and emission of HC is prevented by having forbidden the bypass, the exhaust air engine performance improves synthetically.
[0036] Since the exhaust air purification catalyst is activated on the other hand when judged with Tcat being more than predetermined temperature T0 whenever [catalyst temperature] in S7, it progresses to S10, the close by-pass bulb completely of the bypass valve 10 is carried out, and a bypass is stopped. In addition, the supercharger engine speed Nt rises compulsorily to the initial target engine speed nickel immediately after engine starting as mentioned above. If it does in this way, the great portion of exhaust air is first passed to turbine 4b, the supercharger engine speed Nt can be raised even to an engine speed higher than the minimum engine speed Nmin, and a by-pass rate can be made to increase after that immediately after engine starting. For this reason, since it seems that the supercharger engine speed Nt is not less than the minimum engine speed Nmin immediately after making a by-pass rate increase, a bypass can be made to be able to continue for a long time, and activation of an exhaust air purification catalyst can be sped up.
[0037] Next, other operation gestalten of this invention are explained. With the previous 1st operation gestalt, when [which carried out predetermined time progress from engine starting] it usually sometimes judged with the supercharger rotational frequency Nt being lower than the minimum rotational frequency Nmin, we decided not to be based on Tcat whenever [catalyst temperature], but to close a bypass valve 10 uniformly. This operation gestalt is different at this point, and explains only that difference below.
[0038] Drawing 6 is a flow chart which shows the opening control flow of the bypass valve 10 concerning this operation gestalt, and gives the same sign to the step which performs the same processing as the thing of drawing 2 concerning the 1st operation gestalt. If it judges that Tcat is lower than the predetermined temperature T0 (for example, 200 degrees C) whenever [catalyst temperature] in S7 after carrying out predetermined time progress from engine starting (the control immediately after engine starting is the same as that of the thing of the 1st operation gestalt.), it will progress to S8.
[0039] In S8, it judges whether the supercharger rotational frequency Nt is more than the minimum rotational frequency Nmin. Here, when it judges with Nt being more than Nmin, it progresses to S91 and the opening a of a bypass valve 10 is set as the predetermined opening alpha (for example, full open opening). On the other hand, when it judges with Nt being lower than Nmin, it progresses to S92. Although carried out to making a bypass valve (as opposed to having carried out the close by-pass bulb completely of the bypass valve 10 with the 1st operation gestalt here) 10 open in S92, opening a at this time is taken as the value which performed predetermined reduction amendment to the above-mentioned predetermined opening alpha. And it supposes that this reduction amendment is performed based on difference Nmin-Nt of the minimum rotational frequency Nmin and the supercharger rotational frequency Nt, and Opening a is set as the value which subtracted the amount f of amendments according to the above-mentioned difference (Nmin-Nt) from the predetermined opening alpha.
[0040] Although a by-pass rate will be increased by this as compared with the 1st operation gestalt which was carrying out the close by-pass bulb completely of the bypass valve 10, the by-pass rate at this time becomes less than the amount adjusted by S91 in this operation gestalt, therefore can plan the temperature up of an exhaust air purification catalyst within limits which can maintain the supercharger rotational frequency Nt according to this operation gestalt, and can reconcile these.
[0041] In addition, in the 2nd operation gestalt, when it judges with the supercharger engine speed Nt being lower than the initial target engine speed nickel immediately after engine starting, it is still better also as (S6) and not carrying out the close by-pass bulb completely of the bypass valve 10 uniformly, and making this open under predetermined conditions. That is, in the above explanation, when it judged with the supercharger engine speed Nt being lower than the initial target engine speed nickel in S6, we progressed to S10 and decided to carry out the close by-pass bulb completely of the bypass valve 10. When it progresses to S10 similarly, predetermined reduction amendment is performed to the predetermined opening alpha concerning a bypass valve 10 (for example, full open opening), and only the opening a after amendment makes a bypass valve 10 open as another example.
[0042] Thereby, even if it is before the supercharger rotational frequency Nt reaches the initial target rotational frequency nickel, the temperature up of an exhaust air purification catalyst can be planned within limits which can raise Nt even to nickel. Here, this reduction amendment is similarly performed based on difference nickel-Nt of the initial target rotational frequency nickel and the supercharger rotational frequency Nt in S92 of the point (a=alpha-g (nickel-Nt): g is taken as a correction function.).

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the internal combustion engine with a supercharger concerning 1 operation gestalt of this invention (diesel power plant)
[Drawing 2] The flow chart of the bypass valve opening control routine by the control device of an internal combustion engine same as the above
[Drawing 3] Supercharger rotational frequency detection map
[Drawing 4] Supercharger minimum rotational frequency setting map
[Drawing 5] Initial target rotational frequency setting map of a supercharger
[Drawing 6] The flow chart of the bypass valve opening control routine by the control device of the internal combustion engine concerning other operation gestalten of this invention
[Description of Notations]
1 -- Diesel power plant
2 -- Engine
3 -- Inhalation-of-air path
4 -- Turbosupercharger
5 -- Injector
6 -- Common rail
7 -- Flueway
8 -- Exhaust air purification catalyst
9 -- Bypass path
10 -- Bypass valve
11 -- Actuator
41 -- Electronic control unit

[Translation done.]

* NOTICES *

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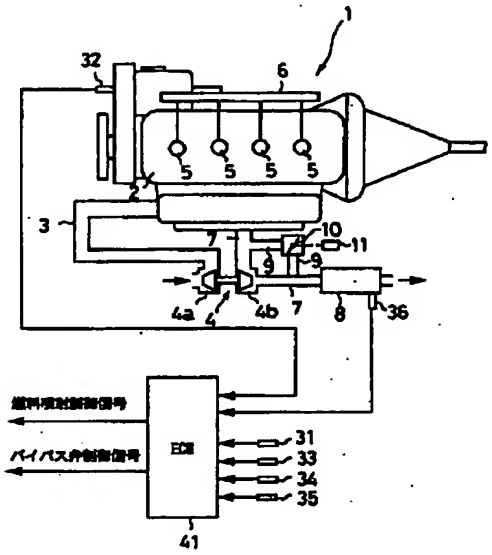
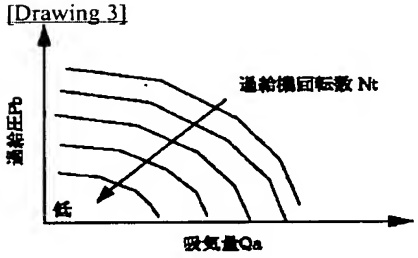
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

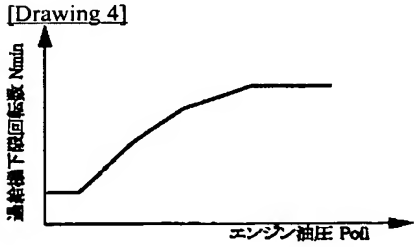
[Drawing 1]



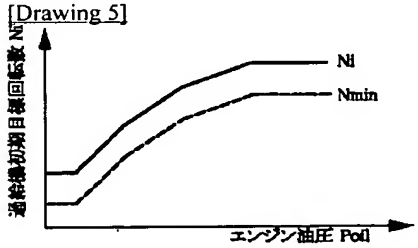
[Drawing 3]



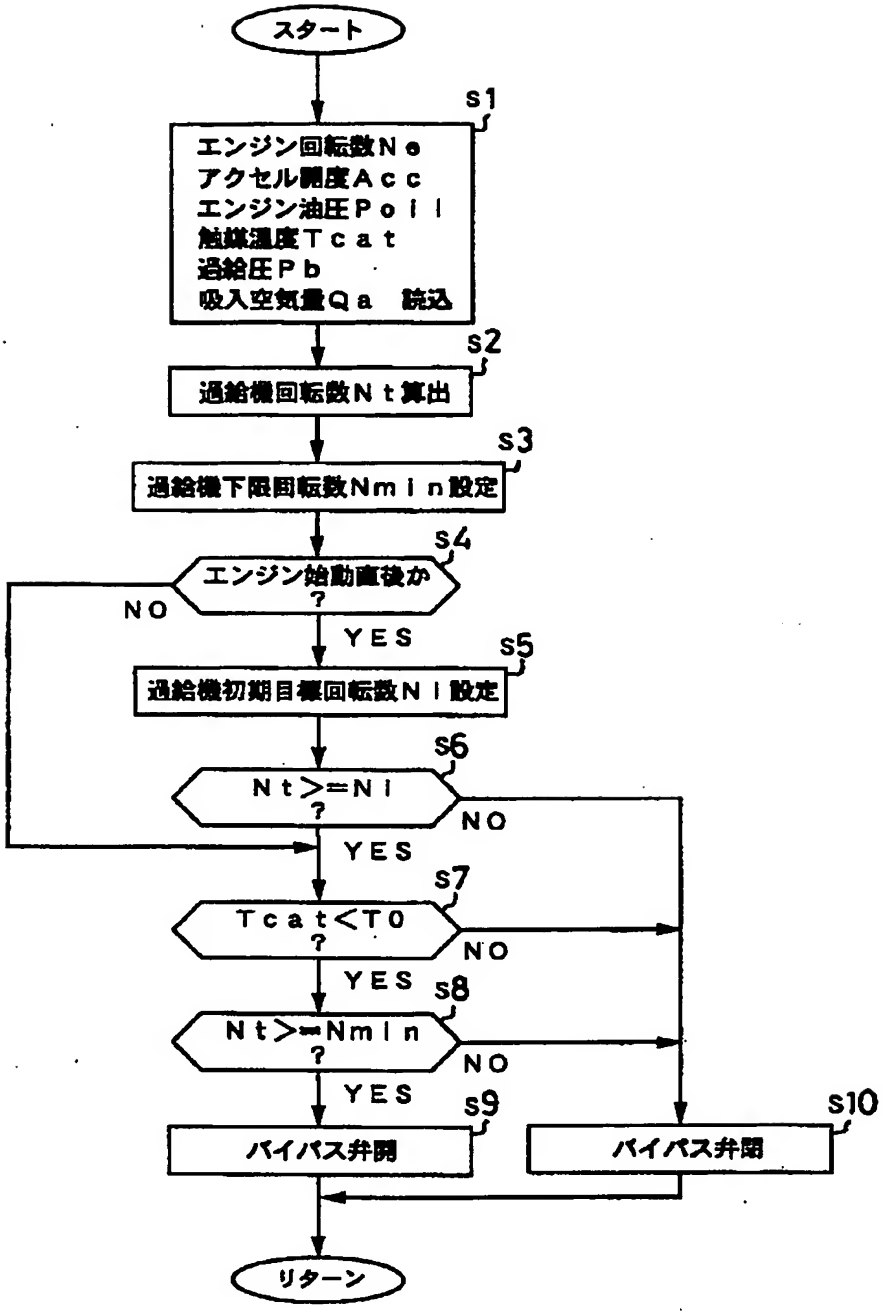
[Drawing 4]



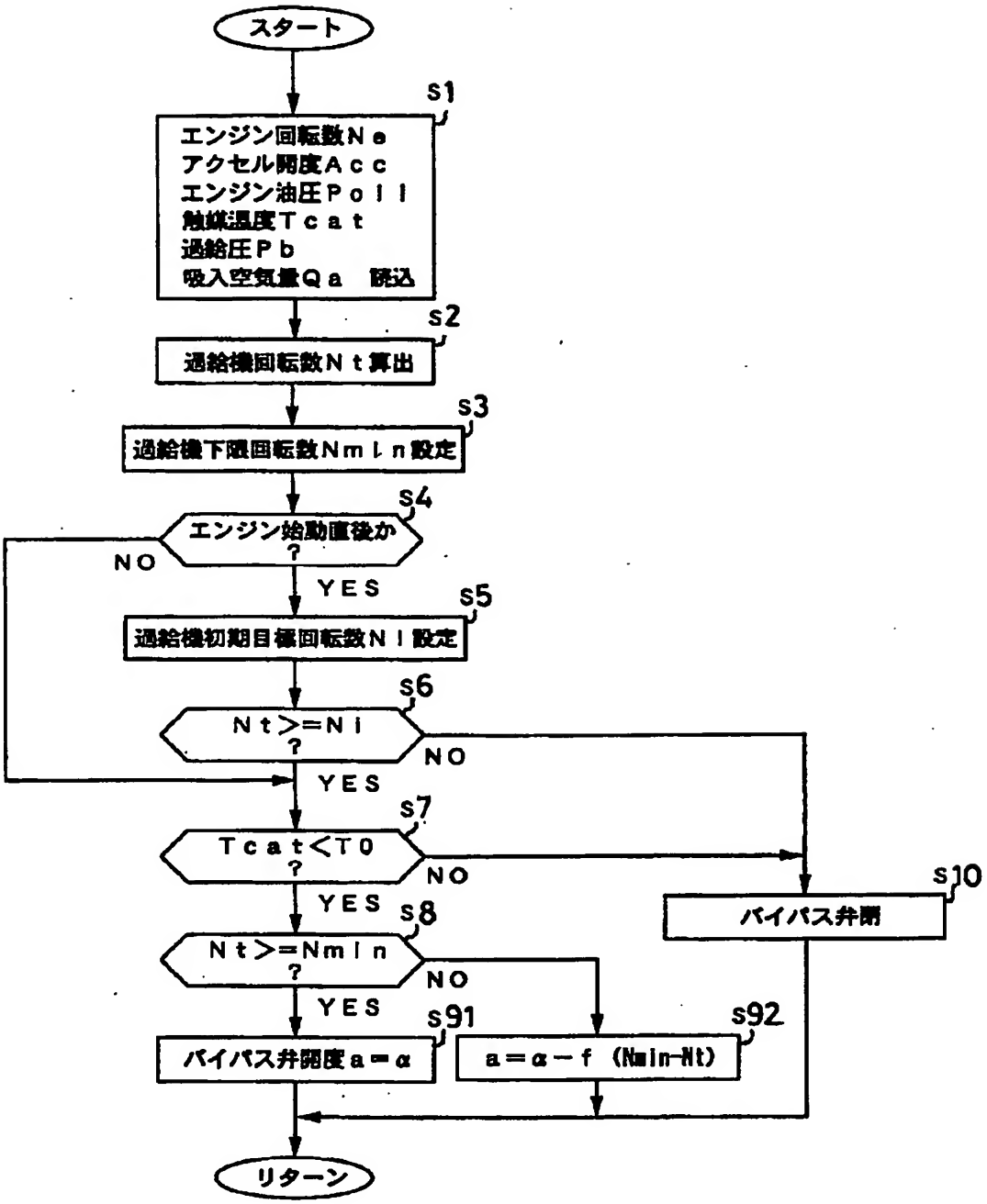
[Drawing 5]



[Drawing 2]


スタート
s1
エンジン回転数Ｎｅ
アクセル開度Ａｃｃ
エンジン油圧Ｐｏｉｌ
触媒温度Ｔｃａｔ
過給圧Ｐｂ
吸入空気量Ｑａ　読込
s2
過給機回転数Ｎｔ算出
s3
過給機下限回転数Ｎｍｉｎ設定
s4
エンジン始動直後か？
NO
YES
s5
過給機初期目標回転数Ｎｉ設定
s6
Ｎｔ>=Ｎｉ？
NO
YES
s7
Ｔｃａｔ<Ｔ０？
NO
YES
s8
Ｎｔ>=Ｎｍｉｎ？
NO
YES
s9
バイパス弁開
s10
バイパス弁閉
リターン

[Drawing 6]



[Translation done.]

Patent Abstracts of Japan

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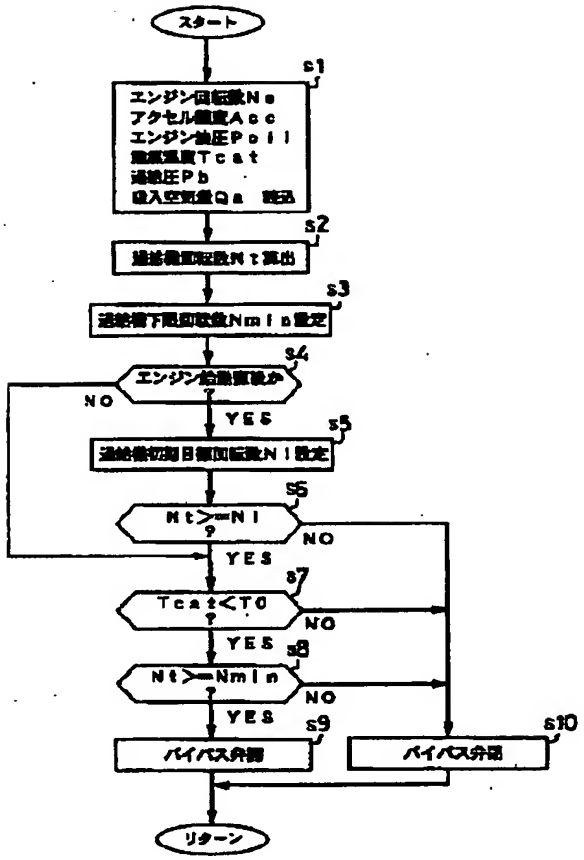
APPLICATION NUMBER : 2001365487

APPLICANT : NISSAN MOTOR CO LTD;

INVENTOR : KAWAMOTO KEIJI;

INT.CL. : F01N 3/20 F01N 3/24 F02B 37/18 F02B 39/14 F02D 23/00

TITLE : INTERNAL COMBUSTION ENGINE WITH TURBOCHARGER



ABSTRACT : PROBLEM TO BE SOLVED: To prevent any oil leakage from a center housing by maintaining the number of rotation of a turbocharger in a predetermined range when activating a catalyst by bypassing a turbine of a turbocharger.

SOLUTION: When the catalyst temperature Tcat is lower than the predetermined temperature T0, and the catalyst must be heated (S7), the exhaust emission is allowed to flow via a bypass passage to bypass the turbine of the turbocharger, and the exhaust emission of large calorie is fed to the catalyst. When the number of rotation Nt of the turbocharger is smaller than the predetermined lower limit number of rotation Nmin (S8), the bypassing is prohibited (S10), and the quantity of exhaust emission flowing into the turbine is increased to maintain the rotation of the turbocharger.

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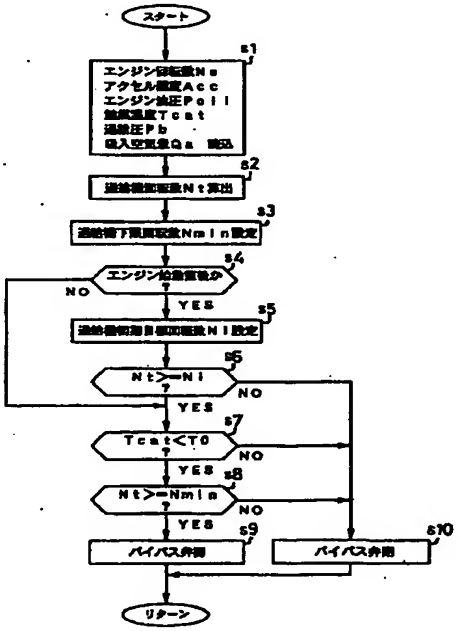
(71)出願人　000003997
日産自動車株式会社
神奈川県横浜市神奈川区宝町２番地
(72)発明者　河本　桂二
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内
(74)代理人　100078330
弁理士　笹島　富二雄

最終頁に続く

(54)【発明の名称】　過給機付き内燃機関

(57)【要約】
【課題】ターボ過給機のタービンをバイパスさせて触媒の活性化を図る際に、過給機回転数を所定範囲に維持することにより、センターハウジングからの油漏れを防止する。
【解決手段】触媒温度Ｔｃａｔが所定温度Ｔ０よりも低く、触媒を昇温させる必要がある場合には（Ｓ７）、ターボ過給機のタービンを迂回するバイパス通路を介して排気を流し、熱量の大きな排気を触媒に供給する。ここで、過給機回転数Ｎｔが所定の下限回転数Ｎｍｉｎよりも低い場合には（Ｓ８）、バイパスを禁止し（Ｓ１０）、タービンに流入する排気を多くして、過給機の回転維持を図る。



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【特許請求の範囲】

【請求項１】排気通路に過給機のタービンと、このタービンの下流に設置された排気浄化装置とを備える過給機付き内燃機関であって、

前記タービンの上流と前記タービンの下流のうち前記排気浄化装置よりも上流側とを連通するバイパス通路と、このバイパス通路に設置されたバイパス弁と、このバイパス弁を制御して前記バイパス通路を流れる排気の流量であるバイパス量を制御するバイパス弁制御装置とを備え、

前記バイパス弁制御装置は、前記バイパス量を最小として過給を行わせる過給モードと、前記バイパス量を大きくして前記排気浄化装置に備わる排気浄化触媒の昇温を行わせる触媒昇温モードと、前記バイパス量を前記触媒昇温モードのものよりも小さくして過給機回転数を所定回転数以上に上昇させる回転維持モードとを選択的に切り換えるモード切換手段を含んで構成され、

前記モード切換手段は、前記排気浄化触媒の温度が所定温度以上であるときに過給モードを選択し、この温度が前記所定温度よりも低くかつ過給機回転数が所定回転数以上であるときに触媒昇温モードを選択し、この温度が前記所定温度よりも低くかつ過給機回転数が前記所定回転数よりも低いときに回転維持モードを選択することを特徴とする過給機付き内燃機関。

【請求項２】排気通路に過給機のタービンと、このタービンの下流に設置された排気浄化装置とを備える過給機付き内燃機関であって、

前記タービンの上流と前記タービンの下流のうち前記排気浄化装置よりも上流側とを連通するバイパス通路と、このバイパス通路に設置されたバイパス弁と、このバイパス弁を制御して前記バイパス通路を流れる排気の流量であるバイパス量を制御するバイパス弁制御装置とを備え、

前記バイパス弁制御装置は、前記バイパス量を最小として過給を行わせる過給モードと、前記バイパス量を増加させて前記排気浄化装置に備わる排気浄化触媒の昇温を行わせる触媒昇温モードとを選択的に切り換えるモード切換手段と、選択されたモードに応じて前記バイパス弁の開度を設定する弁開度設定手段とを含んで構成され、

前記モード切換手段は、前記排気浄化触媒の温度が所定温度以上であるときに過給モードを選択する一方で、この温度が前記所定温度よりも低いときには触媒昇温モードを選択し、

前記弁開度設定手段は、触媒昇温モードにあるときに、前記バイパス弁の開度を過給機回転数に基づいて設定し、この回転数が所定回転数よりも低いときは、それ以上のときと比較してこの開度を小さくすることを特徴とする過給機付き内燃機関。

【請求項３】前記弁開度設定手段は、触媒昇温モードにおいて前記バイパス弁の開度を設定する際に、過給機回転数が低いときほどこの開度を減少させる請求項２に記載の過給機付き内燃機関。

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【請求項４】前記弁開度設定手段は、触媒昇温モードにおいて前記バイパス弁の開度を設定する際に、過給機回転数が前記所定回転数よりも低いときは、この開度を最小とする請求項２に記載の過給機付き内燃機関。

【請求項５】機関始動直後において、前記所定回転数が通常時における第１の値よりも高い第２の値に切り換えられる請求項１～４のいずれか１つに記載の過給機付き内燃機関。

【請求項６】前記所定回転数が潤滑油圧が高いときほど高い値に設定される請求項１～５のいずれか１つに記載の過給機付き内燃機関。

【請求項７】前記バイパス弁制御装置は、前記過給機のコンプレッサの下流における吸気圧を検出する手段を有し、この手段により検出された吸気圧に基づいて過給機回転数が検出される請求項１～６のいずれか１つに記載の過給機付き内燃機関。

【請求項８】前記バイパス弁制御装置は、吸入空気量を検出する手段を有し、この手段により検出された吸入空気量に基づいて過給機回転数が検出される請求項１～７のいずれか１つに記載の過給機付き内燃機関。

【請求項９】前記バイパス弁制御装置は、前記排気浄化触媒の担体の温度を推定若しくは検出する手段を有する請求項１～８のいずれか１つに記載の過給機付き内燃機関。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、過給機付き内燃機関に関し、詳細には、ターボ過給機を備えるとともにそのタービンの下流に排気浄化装置を備える内燃機関において、排気をこのタービンをバイパスさせて流すことにより排気浄化装置に備わる排気浄化触媒を活性化させる技術の改良に関する。

【０００２】

【従来の技術】近年、ディーゼルエンジンからの排気を浄化するために、触媒を使用して排気中のＨＣ（炭化水素），ＣＯ（一酸化炭素）及びＮＯｘ（窒素酸化物）を低減することが実用され始めている。ここで、ディーゼルエンジンでは、一般的にターボ過給機を設けて出力向上が図られているが、排気温度が本質的に低くなるために、触媒が活性状態となる温度に到達する運転条件が限られてしまい、触媒による排気浄化効果が低いという問題がある。

【０００３】この問題に対して、過給機のタービンをバイパスする通路を設け、触媒が活性化していないときは、この通路を介して排気を流すことにより、タービンを迂回して熱量が保持された排気を触媒に供給することが知られている（特開平０５－０４４４４８号公報参照）。

【０００４】
【発明が解決しようとする課題】しかしながら、触媒不活性時に単に排気をバイパスさせることとしただけでは、ターボ過給機のセンターハウジングからのオイルシールが充分には機能せずに潤滑油がタービン側に漏れ出すことがある。すなわち、バイパスの間はタービンを旋回させる力が低下するために過給機回転数が低下することとなるが、ここで触媒が低温状態にあることのみをもってバイパスさせることとすると、回転数が過度に低下してタービンシャフトのシール部材がセンターハウジングに押し付けられる力が弱まり、軸受けに供給された潤滑油がタービン側に漏れ出すからである。このような潤滑油の漏洩は、単に潤滑油消費量を増加させるだけでなく、排気中のＨＣを増加させるので排気特性にも悪影響を及ぼす。
【０００５】そこで、本発明は、タービンをバイパスさせて触媒の活性化を図るに際して、過給機回転数を所定範囲に維持することにより、潤滑油の漏洩といった従来の問題を解消することを目的とする。
【０００６】
【課題を解決するための手段】このため、請求項１に記載の発明では、排気通路に過給機のタービンと、このタービンの下流に設置された排気浄化装置とを備える過給機付き内燃機関において、上記タービンの上流と、その下流のうち排気浄化装置よりも上流側とをバイパス通路で連通し、このバイパス通路にバイパス弁を設置した。そして、このバイパス弁を制御してバイパス通路を流れる排気の流量であるバイパス量を制御するバイパス弁制御装置を設け、この装置において、バイパス量を最小として過給を行わせる過給モードと、バイパス量を大きくして排気浄化装置に備わる排気浄化触媒の昇温を行わせる触媒昇温モードと、バイパス量を触媒昇温モードのものよりも小さくして過給機回転数を所定回転数以上に上昇させる回転維持モードとを選択的に切り換えるモード切換手段を備えた。さらに、モード切換手段は、排気浄化触媒の温度が所定温度以上であるときに過給モードを選択し、この温度が前記所定温度よりも低くかつ過給機回転数が所定回転数以上であるときに触媒昇温モードを選択し、この温度が前記所定温度よりも低くかつ過給機回転数が前記所定回転数よりも低いときに回転維持モードを選択するように構成した。
【０００７】このような構成によれば、排気浄化触媒が高温であるときは過給モードによりバイパス量が最小とされて過給が行われるが、これが低温であり強制的な加熱を必要とするときには、触媒昇温モードか又は回転維持モードかが選択される。ここで、触媒昇温モードが選択されるのは、加熱要求時であり、かつ過給機回転数がある程度高いときである。このしきい値としての回転数は、タービンシャフトに設けられるオイルシールとの関連で設定されるのが好ましく、後述するように潤滑油圧に応じて増減されるとより好適である。触媒昇温モードでは、排気浄化触媒の昇温に重点が置かれることとなるが、過給機が高速で回転しているのでオイルシールを適正に機能させることが可能である。
【０００８】その一方で、回転維持モードが選択されるのは、加熱要求時ではあるが、過給機回転数が低くなっている（あるいは、機関始動から一度も所定回転域に達していない）ときである。このときにバイパス量を多くし過ぎると、過給機回転数が不足して、オイルシールを適正に機能させることができなくなるおそれがある。従って、回転維持モードでは、バイパスにより排気浄化触媒の昇温を行わせるのが好ましいが、過給機の回転維持にも考慮することとする。これにより、オイルシールを適正に機能させることができる限度でこの昇温を行わせ、タービン側への油漏れを防止しつつ、排気浄化触媒の早期活性化を図ることができる。
【０００９】請求項２に記載の発明では、特に、上記バイパス弁制御装置において、（Ａ）バイパス量を最小として過給を行わせる過給モードと、バイパス量を増加させて排気浄化触媒の昇温を行わせる触媒昇温モードとを選択的に切り換えるモード切換手段と、（Ｂ）選択されたモードに応じてバイパス弁の開度を設定する弁開度設定手段とを設けた。そして、モード切換手段では、排気浄化触媒の温度が所定温度以上であるときに過給モードを選択する一方で、この温度が前記所定温度よりも低いときには触媒昇温モードを選択することとし、弁開度設定手段では、触媒昇温モードにあるときに、バイパス弁の開度を過給機回転数に基づいて設定し、この回転数が所定回転数よりも低いときは、それ以上のときと比較してこの開度を小さくすることとした。
【００１０】このような構成では、請求項１に記載のものとは異なり、モードは大別して、加熱要求のないときに選択される過給モードと、加熱要求時に選択される触媒昇温モードとに分かれる。しかしながら、触媒昇温モードにおいて、バイパス弁の開度が過給機回転数に基づいて設定され、この回転数が所定回転数よりも低いときにはバイパス量が少なくされるので、請求項１と同様な効果を得ることが可能である。
【００１１】請求項３に記載の発明では、上記弁開度設定手段が触媒昇温モードにおいてバイパス弁の開度を設定する際に、過給機回転数が低いときほどこの開度を減少させるようにした。請求項４に記載の発明では、弁開度設定手段が触媒昇温モードにおいてバイパス弁の開度を設定する際に、過給機回転数が上記所定回転数よりも低いときは、この開度を最小とすることとした。
【００１２】請求項５に記載の発明によれば、機関始動直後において、上記所定回転数を通常時における第１の値よりも高い第２の値に切り換えることとした。このような構成によれば、機関始動時に排気浄化触媒が低温である場合に、始動後にまず、排気浄化触媒の温度及び過

給機回転数により回転維持モード（請求項１）又は触媒昇温モード（請求項２）が選択される。ここでは、バイパス量が最小とされて、速やかな回転上昇が図られるのが好ましい。この後、排気浄化触媒が活性化しないうちは、過給機回転数が上記所定回転数に達するまで同じモードが選択され続けることになる。ここで、機関始動直後には所定回転数が比較的高い第２の値とされるため、過給機回転数は、まずこの第２の値にまで強制的に高められることになる。従って、過給機の回転上昇が得られてバイパス量が増加されたとしても、過給機回転数がすぐには第１の値の回転数を下回らないので、バイパス量の多い状態を長時間継続させることができる。

【００１３】請求項６に係る発明では、上記所定回転数を潤滑油圧が高いときほど高い値に設定することとした。すなわち、過給機回転数が同じであっても、潤滑油圧が高ければそれだけ潤滑油がタービン側に漏れ出し易くなるので、潤滑油圧の上昇に応じて過給機回転数を高く維持するためである。ここで、所定回転数とは、機関始動直後におけるもの（第１の値）及び通常時におけるもの（第２の値）のいずれであってもよいが、これらの両方を潤滑油圧に基づいて設定すると好適である。

【００１４】請求項７に記載の発明では、バイパス弁制御装置に過給機のコンプレッサの下流における吸気圧を検出する手段を設け、この手段により検出された吸気圧に基づいて過給機回転数が検出されるようにした。請求項８に記載の発明では、バイパス弁制御装置に吸入空気量を検出する手段を設け、この手段により検出された吸入空気量に基づいて過給機回転数が検出されるようにした。

【００１５】請求項９に記載の発明では、バイパス弁制御装置に排気浄化触媒の担体の温度を推定若しくは検出する手段を設けた。

【００１６】

【発明の効果】請求項１に係る発明によれば、タービンをバイパスさせて排気浄化触媒の昇温を行わせる際に、過給機回転数を適正に維持することができるので、タービンシャフトのシール部材がセンターハウジングに押し付けられる力を確保して、タービン側への油漏れによるＨＣの排出を防止できる。

【００１７】請求項２に係る発明によれば、請求項１の効果と同様な効果を得ることができる。請求項３に係る発明によれば、過給機回転数が低いときであってもこれを適正に維持できる限度で排気浄化触媒の昇温を行わせることができるので、触媒の活性時間を短縮できる。

【００１８】請求項４に係る発明によれば、過給機回転数が所定回転数よりも低いときにはバイパス弁の開度を最小とすることで、過給機回転数の過度な低下を確実に防止できる。請求項５に係る発明によれば、機関始動後にまず過給機を所定の高回転域にまで引き上げることで、その後にバイパス量の多い状態を長時間継続させ、排気浄化触媒を速やかに活性化させることができる。

【００１９】請求項６に係る発明によれば、潤滑油圧が高いほど過給機回転数を高く維持することで、運転状態によらずに油漏れを確実に防止できる。請求項７，８に係る発明によれば、過給機のコンプレッサの下流の吸気圧又は吸入空気量（あるいは、これらの両方）に基づいて過給機回転数を検出することで、簡素な制御ロジックと、比較的安価なセンサのみで以上の効果を得ることができる。

【００２０】請求項９に係る発明によれば、担体の温度により排気浄化触媒の温度を正確に検出できる。

【００２１】

【発明の実施の形態】以下に、図面を参照して、本発明の実施の形態について説明する。図１は、本発明の一実施形態に係る内燃機関（以下「エンジン」という。）１の構成図である。エンジン本体２に接続された吸気通路３には、導入部にエアフィルタ（図示せず）が取り付けられており、ここで、吸入空気中に浮遊する粉塵等が除去される。そして、エアフィルタの直ぐ下流に設置されたエアフローメータ３１から吸入空気量に対応した検出信号が出力され、電子制御ユニット（以下「ＥＣＵ」と略す。）４１に入力される。

【００２２】吸気通路３には、ターボ過給機４のコンプレッサ４ａが介装されており、エアフローメータ３１を介した吸入空気は、コンプレッサ部４ａにより圧縮されて送り出される。コンプレッサ部４ａにより圧送された吸入空気は、マニホールド部において各気筒に分配される。エンジン本体２には、各気筒の燃焼室の上部略中央に臨ませて電子制御式燃料噴射弁（以下「インジェクタ」という。）５が設置されている。燃料ポンプにより所定圧力に圧縮された燃料は、燃料供給配管を介してコモンレール６に導入され、そこから各インジェクタ５に供給される。インジェクタ５は、ＥＣＵ４１からの燃料噴射制御信号に応じて作動し、所定の燃料噴射時期に開駆動して、所定量の燃料を筒内に直接噴射する。

【００２３】排気通路７には、ターボ過給機４のタービン４ｂが設置されている。タービン４ｂのタービンホイールと、コンプレッサ４ａのコンプレッサホイールとは、シャフトにより剛的に結合されており、タービン４ｂに流入した排気がタービンホイールを回転させることでコンプレッサホイールが回転し、充填効率が向上されることは言うまでもない。

【００２４】また、排気通路７において、ターボ過給機４のタービン４ｂの上流のうちマニホールド部の合流点よりも下流側と、タービン４ｂの下流のうち後述する排気浄化装置８よりも上流側とが、バイパス通路９により連通されている。バイパス通路９には、この開口面積を調整するためのバイパス弁（ここでは、バタフライ弁）１０が設置されている。バイパス弁１０に対しては、その開度を制御するステッピングモータ等のアクチュエー

タ１１が接続されている。ここで、ＥＣＵ４１からのバイパス弁制御信号に応じてアクチュエータ１１がバイパス弁１０を開弁すると、そのときの開口面積により流量制御される排気がタービン４ｂを迂回して、タービン４ｂの下流の排気通路に合流する。タービン４ｂを介した排気、及びバイパス通路９を介してタービン４ｂを迂回した排気は、ともに排気浄化装置８において浄化処理された後、大気中に放出される。

【００２５】排気浄化装置８には、ディーゼルエンジンの排気を浄化するための排気浄化触媒が担持されている。この触媒としては、酸化触媒や、ＮＯｘトラップ触媒が好適である。ここで、酸化触媒とは、ＣＯ，ＨＣ等の未燃燃料成分を酸化する機能を有するものをいい、また、ここでいうＮＯｘトラップ触媒とは、空燃比がリーンであるときに排気中のＮＯｘをトラップする一方で、空燃比がリッチとなるとトラップしているＮＯｘを放出し及び還元する機能を有するものをいう。

【００２６】他の排気浄化装置８としては、ＤＰＦ（ディーゼル・パティキュレート・フィルタ）を内蔵したものが挙げられる。ここで、ＤＰＦとは、ディーゼルエンジンから排出される粒子状物質をろ過捕集することのできる程度に細かいセラミック等からなる多孔質体をいう。なお、このＤＰＦには、酸化触媒等を触媒成分とする触媒層が形成される。

【００２７】エンジン１において設けられるセンサとしては、エアフローメータ３１の他に、エンジン回転数Ｎｅを算出する際に使用される単位クランク角又は基準クランク角を検出するクランク角センサ３２、運転者のアクセル操作量に相当するアクセル開度Ａｃｃを検出するアクセルセンサ３３、エンジン潤滑油の圧力（以下「エンジン油圧」という。）Ｐｏｉｌを検出する油圧センサ３４、過給圧Ｐｂとして吸気通路３のコレクタ１２内の圧力を検出する過給圧センサ３５が設けられている。また、排気浄化装置８には、担持されている排気浄化触媒の温度（以下「触媒温度」という。）Ｔｃａｔを検出するための触媒温度センサ３６が取り付けられている。触媒温度センサ３６は、触媒の担体の温度を検出するように構成されている。これらのセンサ３１～３６の検出信号は、いずれもＥＣＵ４１に入力される。

【００２８】次に、ＥＣＵ４１により実行される制御のうち、バイパス弁１０の開度制御について、図２に示すフローチャートを参照して説明する。ここで、ＥＣＵ４１は、この制御のために、アクチュエータ１１に対して以下に述べるようにバイパス弁制御信号を送信する。ステップ（以下「Ｓ」と略す。）１では、各センサ３１～３６からの入力信号に基づいて、エンジン回転数Ｎｅ、アクセル開度Ａｃｃ、エンジン油圧Ｐｏｉｌ、触媒温度Ｔｃａｔ、過給圧Ｐｂ及び吸入空気量Ｑａを読み込む。

【００２９】Ｓ２では、吸入空気量Ｑａと、過給圧Ｐｂとに基づいて過給機４の過給機回転数Ｎｔを検出する。この検出は、図３に示すコンプレッサ４ａの作動特性線図を模したマップを参照して推定的に行う。ここで、過給機回転数Ｎｔは、吸入空気量Ｑａが少ないほど、また、過給圧Ｐｂが低いほど低い値として検出される。Ｓ３では、エンジン油圧Ｐｏｉｌに基づいて、図４に示すように過給機下限回転数Ｎｍｉｎを設定する。

【００３０】ここで、下限回転数Ｎｍｉｎは、過給機４のセンターハウジングにおいて適正なオイルシール機能（一般的にタービンシャフトには、シール部材としてピストンリングが装着される。）が得られる限界として設定される。すなわち、過給機回転数Ｎｔが過度に低下すると、シール部材がセンターハウジングに押し付けられる力が弱まりオイルシール機能の不足を来すので、下限回転数Ｎｍｉｎは、シール部材の押付け力が所定に得られる範囲内の最低回転数とする。しかしながら、同じ過給機回転数Ｎｔのもとでも、エンジン油圧Ｐｏｉｌが高い場合と低い場合とを比較すると、前者の方が潤滑油を外部に押し出す力が強くなるので、タービンハウジング内への油漏れを来たし易い。従って、下限回転数Ｎｍｉｎは、エンジン油圧Ｐｏｉｌに応じて適宜変更されるのが好ましく、Ｐｏｉｌが高いときほど高い値に設定される。なお、Ｎｍｉｎは、過給機回転数に係る所定回転数の「第１の値」に相当する。

【００３１】Ｓ４では、現在、エンジン始動直後であるか否かを判定する。この判定方法としては、例えば、スタートスイッチのオフ信号を入力してエンジン始動からの経過時間を算出し、この経過時間が所定時間以内であることをもってエンジン始動直後であると判定する。あるいは、エンジン始動から、過給機回転数Ｎｔが後述する初期目標回転数Ｎｉを最初に上回るまでを、エンジン始動直後としてもよい。

【００３２】以下では、まず、エンジン始動直後の時間帯に限った制御の流れについて説明する。現在、エンジン始動直後であると判定した場合には、Ｓ４からＳ５へ進み、エンジン油圧Ｐｏｉｌに基づいて、図５示すように過給機初期目標回転数Ｎｉを設定する。

【００３３】ここで、初期目標回転数Ｎｉは、過給機回転数Ｎｔと同様にエンジン油圧Ｐｏｉｌが高いときほど高い値に、かつ一定のＰｏｉｌに対して、第１の値としての下限回転数Ｎｍｉｎよりも高い値に設定される。なお、Ｎｉは、過給機回転数に係る所定回転数の「第２の値」に相当する。Ｓ６では、過給機回転数Ｎｔが初期目標回転数Ｎｉ以上であるか否かを判定する。エンジン始動後ＮｔがＮｉよりも低い間は、Ｓ１０へ進み、バイパス弁１０を全閉する。この動作により、この間は、排気の大半がタービン４ａに流されることになる。そして、このようにしてバイパス弁１０を閉じた状態は、エンジン始動から、（触媒温度Ｔｃａｔによらず）過給機回転数Ｎｔが初期目標回転数Ｎｉに達するまで継続され、過給機４は、所定の高回転域にまで速やかに引き上げられ

る。

【００３４】Ｓ６において過給機４が初期目標回転数Ｎｉ以上で回転している場合には、後述するＳ７以降の処理が行われる。次に、エンジン始動から所定時間経過した後の制御として、Ｓ４から先の流れについて説明する。Ｓ４においてエンジン始動直後ではないと判定した場合には、Ｓ７に進み、触媒温度Ｔｃａｔが所定温度Ｔ０よりも低いか否かを判定する。ここで、Ｔ０は、排気浄化装置８に備わる排気浄化触媒の活性下限温度（例えば、２００℃）に設定される。ＴｃａｔがＴ０よりも低いと判定した場合には、Ｓ８へ進む。

【００３５】Ｓ８では、過給機回転数Ｎｔが下限回転数Ｎｍｉｎ以上であるか否かを判定する。ここで、ＮｔがＮｍｉｎ以上であると判定したときにのみＳ９へ進み、バイパス弁１０を開くこととする。一方で、ＮｔがＮｍｉｎよりも低いと判定した場合には、排気浄化触媒が不活性状態にあり昇温する必要があるときであってもＳ１０へ進み、バイパス弁１０を全閉させる。この動作によると、排気浄化触媒の活性化に多少の遅れが出ることになる。しかしながら、バイパスを禁止させたことにより過給機回転数Ｎｔが上昇し、オイルシール機能の低下を防止してＨＣの放出が防がれるので、総合的には排気性能が向上される。

【００３６】一方、Ｓ７において触媒温度Ｔｃａｔが所定温度Ｔ０以上であると判定された場合には、排気浄化触媒が活性化されているので、Ｓ１０へ進み、バイパス弁１０を全閉させてバイパスを停止させる。なお、前述のように、過給機回転数Ｎｔは、エンジン始動直後において初期目標回転数Ｎｉにまで強制的に上昇される。このようにすれば、エンジン始動直後に、まず排気の大半をタービン４ｂに流して過給機回転数Ｎｔを下限回転数Ｎｍｉｎよりも高い回転数にまで上昇させ、その後にバイパス量を増加させていくことができる。このため、バイパス量を増加させた後に過給機回転数Ｎｔがすぐに下限回転数Ｎｍｉｎを下回るようなことがないので、バイパスを長時間継続させ、排気浄化触媒の活性化を速めることができる。

【００３７】次に、本発明の他の実施形態について説明する。先の第１実施形態では、エンジン始動から所定時間経過した通常時において過給機回転数Ｎｔが下限回転数Ｎｍｉｎより低いと判定した場合には、触媒温度Ｔｃａｔによらず一律にバイパス弁１０を閉じることとした。本実施形態は、この点で相違しており、以下にその相違のみを説明する。

【００３８】図６は、本実施形態に係るバイパス弁１０の開度制御の流れを示すフローチャートであり、第１実施形態に係る図２のものと同じ処理を行うステップには、同じ符号を付している。エンジン始動から所定時間経過した後（エンジン始動直後の制御は、第１実施形態のものと同様である。）、Ｓ７において触媒温度Ｔｃａｔが所定温度Ｔ０（例えば、２００℃）よりも低いと判定されると、Ｓ８へ進む。

【００３９】Ｓ８では、過給機回転数Ｎｔが下限回転数Ｎｍｉｎ以上であるか否かを判定する。ここで、ＮｔがＮｍｉｎ以上であると判定した場合には、Ｓ９１へ進み、バイパス弁１０の開度ａを所定開度α（例えば、全開開度）に設定する。その一方で、ＮｔがＮｍｉｎよりも低いと判定した場合には、Ｓ９２へ進む。Ｓ９２では、（第１実施形態では、ここでバイパス弁１０を全閉していたのに対して）バイパス弁１０を開かせることとするが、このときの開度ａは、上記所定開度αに所定の減少補正を施した値とする。そして、この減少補正は、下限回転数Ｎｍｉｎと過給機回転数Ｎｔとの差Ｎｍｉｎ－Ｎｔに基づいて行うこととし、開度ａは、所定開度αから上記差に応じた補正量ｆ（Ｎｍｉｎ－Ｎｔ）を減じた値に設定される。

【００４０】これにより、バイパス弁１０を全閉していた第１実施形態と比較して、バイパス量が増加されることとなるが、このときのバイパス量は、本実施形態においてＳ９１で調整される量よりは少なくなる、従って、本実施形態によれば、過給機回転数Ｎｔを維持できる範囲内で排気浄化触媒の昇温を図ることができ、これらを両立させることができる。

【００４１】なお、第２実施形態においては、さらに、エンジン始動直後において過給機回転数Ｎｔが初期目標回転数Ｎｉよりも低いと判定した場合に（Ｓ６）、一律にバイパス弁１０を全閉させるのではなく、所定の条件のもとでこれを開かせることとしてもよい。すなわち、以上の説明では、Ｓ６において過給機回転数Ｎｔが初期目標回転数Ｎｉよりも低いと判定した場合には、Ｓ１０へ進み、バイパス弁１０を全閉させることとした。別の例としては、同様にしてＳ１０へ進んだ場合に、バイパス弁１０に係る所定開度α（例えば、全開開度）に所定の減少補正を施し、補正後の開度ａだけバイパス弁１０を開かせる。

【００４２】これにより、過給機回転数Ｎｔが初期目標回転数Ｎｉに達する前であっても、ＮｔをＮｉにまで上昇させることのできる範囲内で排気浄化触媒の昇温を図ることができる。ここで、この減少補正は、先のＳ９２におけると同様に、初期目標回転数Ｎｉと過給機回転数Ｎｔとの差Ｎｉ－Ｎｔに基づいて行う（ａ＝α－ｇ（Ｎｉ－Ｎｔ）：ｇは、補正関数とする。）。

【図面の簡単な説明】

【図１】本発明の一実施形態に係る過給機付き内燃機関（ディーゼルエンジン）の構成図

【図２】同上内燃機関の制御装置によるバイパス弁開度制御ルーチンのフローチャート

【図３】過給機回転数検出マップ

【図４】過給機下限回転数設定マップ

【図５】過給機初期目標回転数設定マップ

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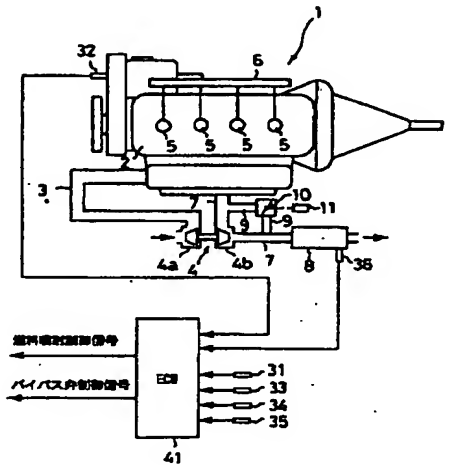
【図６】本発明の他の実施形態に係る内燃機関の制御装置によるバイパス弁開度制御ルーチンのフローチャート

【符号の説明】

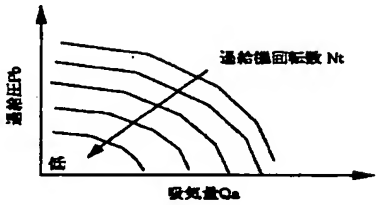
１…ディーゼルエンジン
２…エンジン本体
３…吸気通路
４…ターボ過給機
５…インジェクタ
＊６…コモンレール
７…排気通路
８…排気浄化触媒
９…バイパス通路
１０…バイパス弁
１１…アクチュエータ
４１…電子制御ユニット

＊

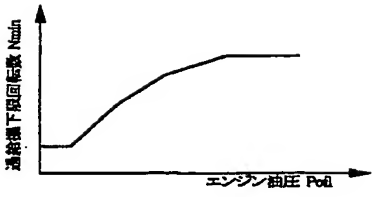
【図１】



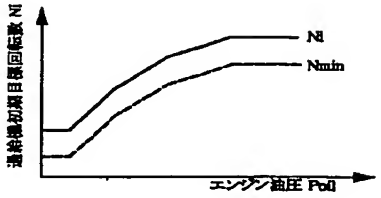
【図３】



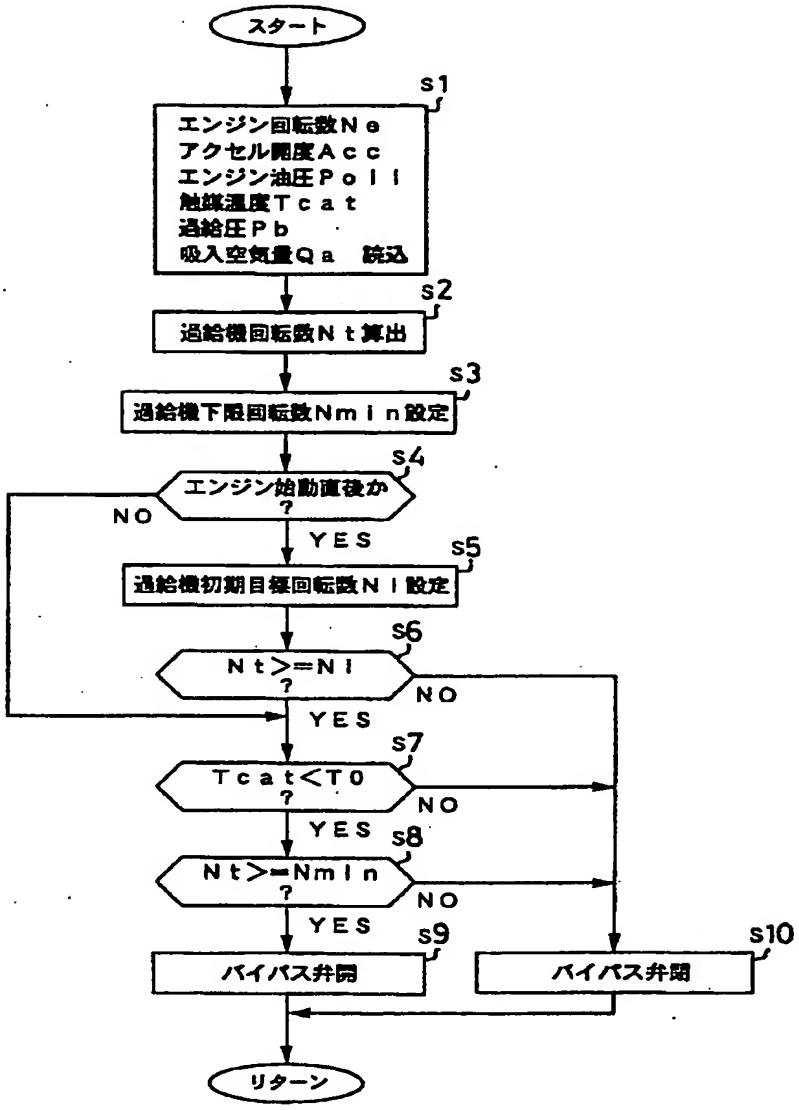
【図４】



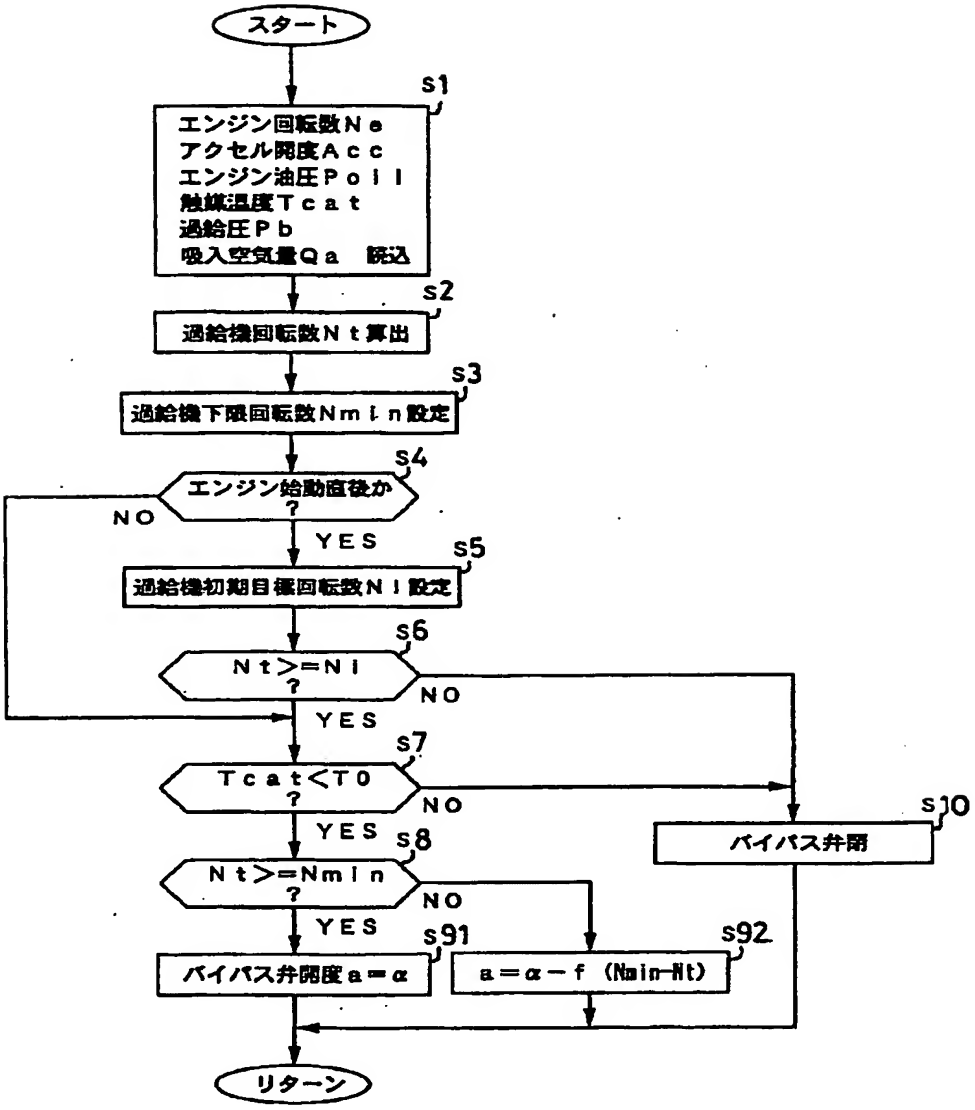
【図５】



【図２】


スタート
s1
エンジン回転数Ｎｅ
アクセル開度Ａｃｃ
エンジン油圧Ｐｏｉｌ
触媒温度Ｔｃａｔ
過給圧Ｐｂ
吸入空気量Ｑａ　読込
s2
過給機回転数Ｎｔ算出
s3
過給機下限回転数Ｎｍｉｎ設定
s4
エンジン始動直後か？
NO
YES
s5
過給機初期目標回転数ＮＩ設定
s6
Ｎｔ>=ＮＩ？
NO
YES
s7
Ｔｃａｔ<Ｔ０？
NO
YES
s8
Ｎｔ>=Ｎｍｉｎ？
NO
YES
s9
バイパス弁閉
s10
バイパス弁開
リターン

【図６】


スタート
S1
エンジン回転数Ｎｅ
アクセル開度Ａｃｃ
エンジン油圧Ｐｏｉｌ
触媒温度Ｔｃａｔ
過給圧Ｐｂ
吸入空気量Ｑａ　読込
S2
過給機回転数Ｎｔ算出
S3
過給機下限回転数Ｎｍｉｎ設定
S4
エンジン始動直後か
？
NO
YES
S5
過給機初期目標回転数Ｎｉ設定
S6
Ｎｔ>=Ｎｉ
？
NO
YES
S7
Ｔｃａｔ<Ｔ０
？
NO
YES
S8
Ｎｔ>=Ｎｍｉｎ
？
NO
YES
S10
バイパス弁閉
S91
バイパス弁開度ａ＝α
S92
ａ＝α－ｆ（Ｎmin-Ｎt）
リターン

フロントページの続き

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EA18 FA02 FB02 FB03 FC07
FC08 HB03 HB06
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FA15 GA01 GA04 GA05 HA01Z
HA05Z HA06Z HA17X HA17Z
HD02X HD02Z